USER MANUAL
UPS 160-300kVA

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1 General Information

1.1 GENERAL DESCRIPTION OF THE UPS

The UPS in question is composed of a metallic frame inside which the electronic power part is developed, accessible from the front painted doors.
The external panelling of the machine can be completely removed; so that it is easy to access from all sides for any purpose.
The right front door contains the user interface panel, for controlling and running the UPS.
Given the specific power of the UPS it is not equipped with internal batteries, these are located in one or two dedicated cabinets.
The cooling system of the machine is composed of a hydraulic circuit (filled with water and an addition of glycol) and forced air, suctioned from the base of the UPS and ejected by a system of front ventilation grids in the exchanger section, located on the left of the front of the machine

1.1.1 Fields of use of the UPS

The new UPS is designed to supply stabilised and filtered power to sophisticated electronic systems (in particular to data processing systems) which need to be guaranteed a power source free from voltage and frequency fluctuations, thus hospitals, police stations, motorway tunnels, radio stations, banks, technical and administrative offices and many other applications.

1.1.2 Power and autonomy

Thanks to its modular design the UPS is available in versions with rated power from 160KVA to 300KVA.
Internal batteries are not used for all sizes of the UPS, thus it is necessary to use separate battery cabinets to create the desired autonomy.

1.1.3 Safe and easy use

All of the available controls are perfectly insulated and disconnected from hazardous voltages.
Controls both on overloading and excessive temperatures guarantee the immediate and most opportune intervention in the event that one of these conditions occurs during operation.
The operator can view the status of the UPS on the front panel and perform shutdown or switching operations easily. See chapter 3 page 19.
It is possible to connect one of more external E.P.O. emergency buttons (not supplied) used to control the complete deactivation of the UPS in the event of a fire. Chap.2.7.4
Monitoring of the UPS can be managed remotely, with maximum simplicity through a personal computer and a specific communication program (optional) or via a remote panel (also optional) which is indispensable if the system will be installed in unmonitored areas. See chapters 1.2.5 - 1.2.6

1.2 CONFIGURATIONS AND OPTIONAL EQUIPMENT

1.2.1 Base configuration

The base configuration entails the implementation of the UPS in a single cabinet. It maintains the same mechanical dimensions in all the available configurations and sizes:
-6 pulse 160-300kVA
-12 pulse 160-300kVA
-12 pulse + low THD 160-300KVA

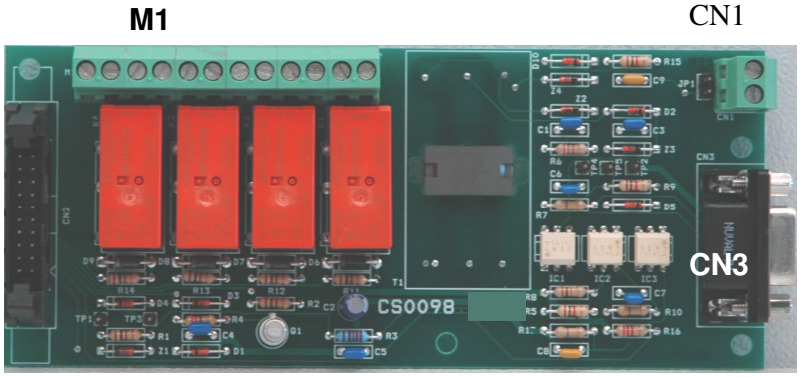
1.2.2 Battery cabinet

If requested the UPS can be supplied complete with batteries for the requested autonomy. The batteries will be housed in an appropriately sized cabinet, complete with disconnection and protection parts.
For batteries not housed in a standard cabinet, it is necessary to create a disconnection and protection panel for them.

1.2.3 Transformer cabinet

An optional cabinet is available with galvanic isolation transformer (output-mains-reserve network) for specific uses.
The standard transformer is three phase/three phase with 1:1 ratio but it can be supplied with a different transformation ratio upon request.

1.2.4 Circuits for remote communication



Remote communication board (the code CS0098), gives possibility of monitoring and communicating with UPS.
Monitoring can be implemented with the PC and dedicated software or through a remote panel. There are also free contacts available on the terminal board M1 (more info at page 19)

1.2.5 UPS MANAGEMENT Software

The Generex “UPS MANAGEMENT” communication software: used for communication between the UPS and a PC or network of PC based on Windows, Win-NT, Novell, OS2, Dec, Linux operating system.
The software is used to control the operating condition of one or more UPS used to supply a personal computer LAN. (for more information see the chap. AUXILIARY CONNECTIONS OF THE UPS on page 17).

1.2.6 Remote panel

The remote panel is used for remote viewing of the UPS operation, it repeats the status of the main blocks with switching on of LEDs and activation of an acoustic alarm.
(for more information see the chap. AUXILIARY CONNECTIONS OF THE UPS on page 17).

1.2.7 Remote EPO pushbutton panel

The remote EPO pushbutton panel is a safety system that gives you the possibility of completely disabling the machine in the event of an emergency.
(for more information see the chap. AUXILIARY CONNECTIONS OF THE UPS on page 17).

1.3 OPERATING PRINCIPLE

The UPS described here is an on-line dual conversion type UPS with automatic by-pass in compliance with European standard EN62040-1-2. This UPS performs a dual conversion of the incoming voltage continuously and without interruption.
The absence of direct mains-load connection does not allow the passage of any disturbance and the dual conversion guarantees an output of always regulated energy, both in voltage and frequency, ideal for the operation of professional uses.
When the input voltage goes out of the allowed tolerances or more simply is not present, the load is supplied by taking energy from the batteries.
The system is supplied with an automatic by-pass; in the event of a fault or overload of the UPS, the by-pass connects the uses directly to the mains via a reserve line, thus making it possible to restore normal operating conditions without supply interruptions to the load. See fig. 1.3.1

1.3.1 UPS block diagram

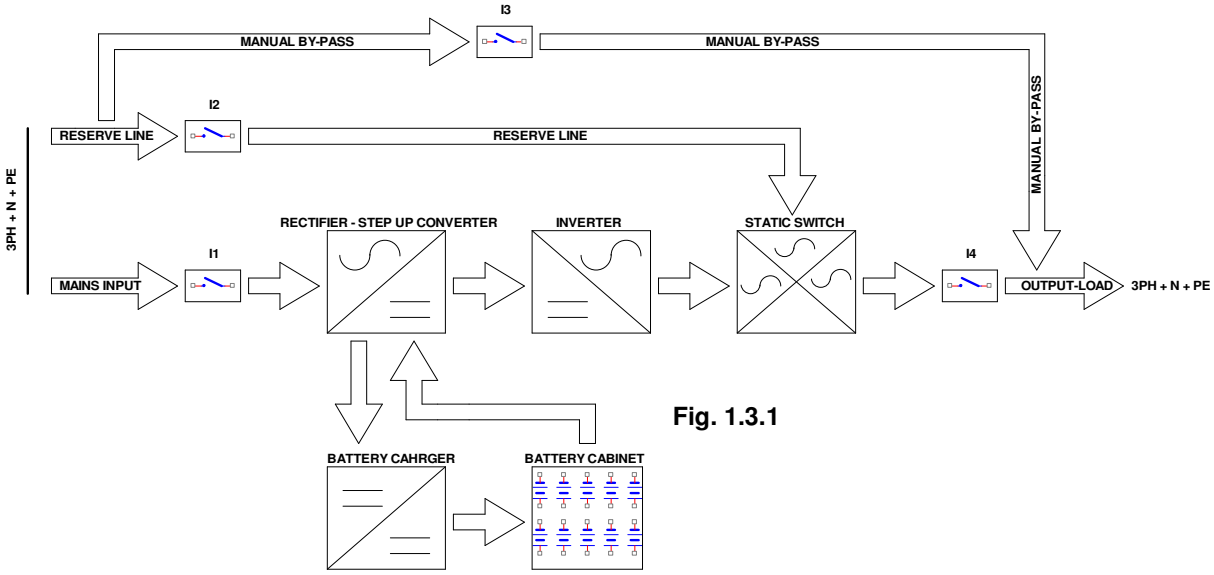


Fig. 1.3.1

1.3.2 Input stage, power module and output stage

From the input bars the mains are connected via the MAINS INPUT I1 switch to the power module.
The rectifier-step-up converter controlled by the control logic, applies the AC/DC conversion to the mains (normal operating condition) or the DC/DC conversion of the battery energy when the mains power is absent or not within the allowed tolerance.
The DC voltage then powers the inverter which reconstructs AC voltage adjusting the current taken based on the load needs.
The last module is the automatic by-pass. It transfers the filtered and regenerated energy from the Inverter to the load, in normal operating conditions, if there is a fault or overload, the UPS output is switched to the reserve line; in this situation it is the mains which maintain the power to the uses. When the causes that provoked switching to the reserve line cease, the by-pass automatically returns to the supply from the inverter.
The filtered, regenerated and stabilised mains is sent to the load via the UPS OUTPUTI4 switch. See diagram 1.3.1

1.3.3 Logic and auxiliary circuits

The control logic is housed on a specific board (CS0090) and represents the "intelligence" of the UPS.
It manages operation of the step-up converter, inverter and by-pass based on feedback comparison of signals taken from the power module. The control logic also manages the other three boards, i.e. the battery charger, auxiliary power supply and signal interface.
The battery charger handles recharging of the outside batteries connected to the UPS.
The signal interface takes the signals from the control logic and converts them into the protocol required for the front panel of the UPS and the relay boards. Going backwards, the criteria from the front panel (automatic by-pass forcing) and/or Relay board (EPO) are sent from the signal interface to the control logic which interprets them and switches on the reserve line and/or immediately shuts off the UPS.
The signal interface may also pilot another optional board (second relay board) in addition to the standard relay board.
The auxiliary power supply supplies all the boards and electronic components in the UPS.

1.3.4 Batteries

The battery supplies energy to the system when the input mains is not suitable or not present, in all other cases it is constantly recharged by the battery charger module so that it is always ready for use when required.

1.3.5 Manual by-pass

The use of the manual by-pass is for cases when it is necessary to disable the UPS keeping the load supplied from the mains (e.g.: UPS stopped, fault, etc.). It is a circuit that can be activated via the MANUAL BY-PASS I4 switch, located on the front part of the UPS, see chap. 4. In normal operating conditions of the UPS this circuit breaker is in home position with a mechanical safety locked inserted (lock with key).

1.3.6 Front panel

The UPS is managed via the front panel, from which it is possible to run the controls, and display and reset the alarm circuits.
The panel is equipped with an LCD used to display the operating status of the UPS, the charge and all types of measurement (see chap. 3)

2 INSTALLATION INSTRUCTIONS

2.1 GENERAL INFORMATION

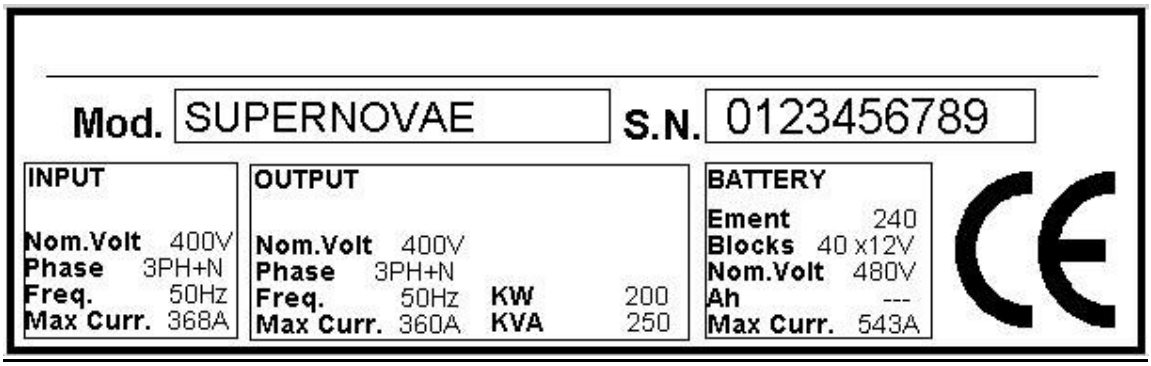
This chapter describes the system installation procedures and lists the following subjects:

2.2 Reception and identification
2.3 Storage
2.4 Positioning the UPS
2.5 Room specifications
2.6 Arrangement and connection to mains
2.7 UPS auxiliary connections
2.8 Earthing

2.2 RECEPTION AND IDENTIFICATION

After removing the packing, visually inspect (inside and outside) the UPS and battery panel (if included) to check for any damage that occurred during shipping. If there is any damage inform the shipper or retailer immediately.
Check the supplied material against the packing slip.
The machine has an adhesive identification plate indicating the type, power and serial number; it is located inside the right door.

Fig. 2.2



2.3 STORAGE

If the system is not going to be installed immediately it must be stores in an environment with adequate protection against excessive humidity and sources of extreme heat (from +5 to +40°C, humidity less than 95% without condensation).

If the battery panel is supplied, also make sure that no more than 6 months passes between one battery recharge and the next. Once this period of time has elapsed, temporarily hook the UPS up to the mains and run it for the time needed to recharge the batteries.

2.4 POSITIONING THE UPS

All of the sizes and configurations of this UPS series have been developed with the same structure, their mechanical specifications are listed in tables 2.4 a-b-c.

6 PULSE VERSION				
POWER (KVA)	DIMENSIONS LxDxH (mm) Without exchanger	DIMENSIONS LxDxH (mm) With exchanger	WEIGHT (Kg) Without exchanger	WEIGHT (Kg) With exchanger
160	1040 x 800 x 1800	1240 x 800 x 1800	540	570
200			570	600
250			600	630
300			600	630

Tab. 2.4a

12 PULSE VERSION				
POWER (KVA)	DIMENSIONS LxDxH (mm) Without exchanger	DIMENSIONS LxDxH (mm) With exchanger	WEIGHT (Kg) Without exchanger	WEIGHT (Kg) With exchanger
160	1040 x 800 x 1800	1240 x 800 x 1800	690	720
200			690	720
250			840	870
300			840	870

Tab. 2.4b

12 PULSE VERSION + 5% THD				
POWER (KVA)	DIMENSIONS LxDxH (mm) Without exchanger	DIMENSIONS LxDxH (mm) With exchanger	WEIGHT (Kg) Without exchanger	WEIGHT (Kg) With exchanger
160	1040 x 800 x 1800	1240 x 800 x 1800	750	780
200			750	780
250			960	990
300			960	990

Tab. 2.4c

The weights and dimensions are differentiated because the liquid – air exchanger of the machine may be built-in to the UPS cabinet or installed in a separate, distant area from it.

For handling you need to remember that the machine, unless special arrangements are made, is shipped and thus handled with the exchanger attached, thus you need to refer to the bigger dimensions and higher weight of the version used.

Once the cabinet is removed from the packing, it can be moved on a pallet with fork lift from the front or the side to the installation site.
Remember that ***all the connections enter from the bottom of the UPS*** under the support surface on the right (fog. 2.4)

Fig. 2.4 shows the bars for housing the cables

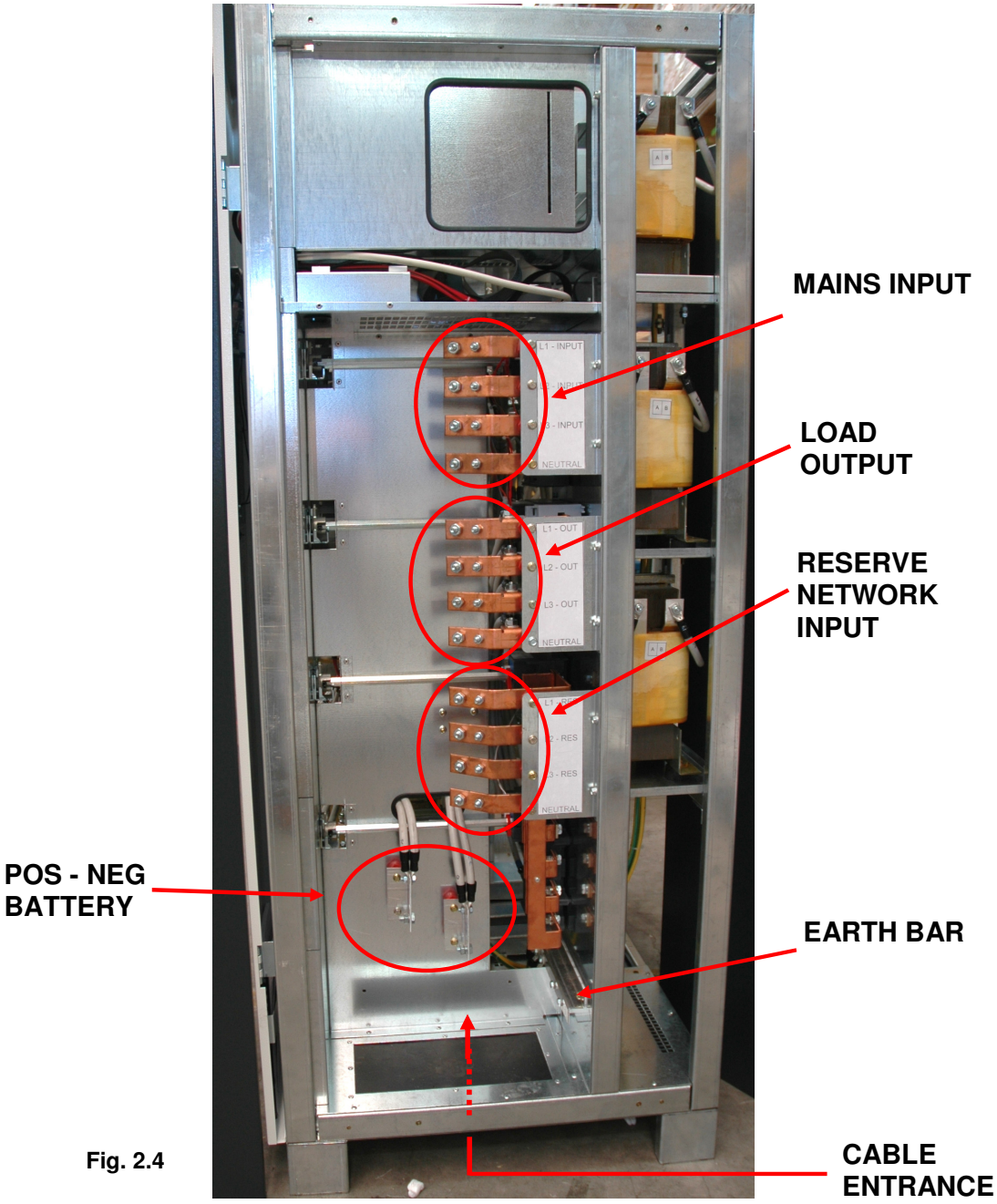


Fig. 2.4

Looking at the UPS from the front, the entrance of the cables is to the lower right, they can be accessed by removing the painted side piece.
All of the cables need to be inserted from the bottom in the specific window for inserting them as shown in figure 2.4

2.5 ROOMS SPECIFICATIONS

The room where the UPS is installed must be clean and must be pollution class 2 (CEI); it must also be able to dissipate the heat produced by the machine, as shown in table 2.5a.

Tab. 2.5a

Powers		
Rated P (KVA)	Diss. P (KW with exchanger	Diss. P(KW) without exchanger
160	8,2	3,5
200	9,9	4,1
250	12,8	5,3
300	15,5	6,5

If the installation also includes the battery panel, the room must be able to ensure an exchange of air equal or greater than what is shown in table 2.5b.

Tab. 2.5b

Air exchange <u>only</u> for battery hydrogen		
Air exchange for 15m auto. (m^3/h)	Air exchange for 30m auto. (m^3/h)	Air exchange for 1h auto. (m^3/h)
10	19	32
13	26	42
16	32	52
19	39	62

Remember that the average life of the batteries is closely tied to the operating temperature; a temperature of around 20°C is normally recommended.
(When the temperature rises above 20°, for each 10° higher the battery life drops by 50%)

2.6 LAYOUT AND CONNECTION TO MAINS

For connection to the mains a layout solutions like the one shown in diagram 2.6° is recommended. The circuit breakers B-C-D are a magnetothermic type without differential protection, or if this is required, with a triggering current greater than 0.5A

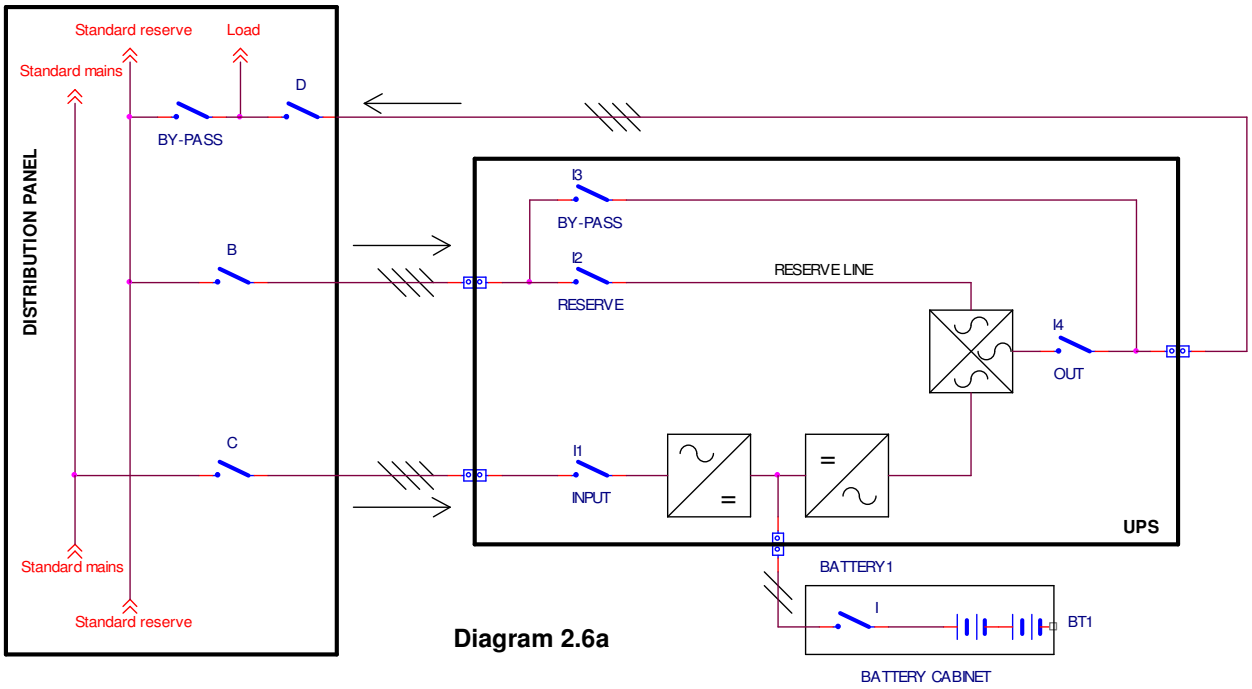


Diagram 2.6a

The control parts and all the power connections of the UPS in question need to be able to permanently support the current shown in tab. 2.6

UPS power (KVA)	Mains input (A)	Reserve input (A)	Use outputs (A)	Battery discharge current (A)
160	242	242	242	350
200	302	302	302	438
250	378	378	378	547
300	454	454	454	600

Table 2.6

WARNING !!

IN ADDITION TO THE CIRCUIT BREAKER AND PROTECTION IT IS ADVISABLE TO SET UP AN APPROPRIATE CHANGE-OVER CONTACT ON THE NETWORK INPUT SIDE OUTSIDE THE UPS TO PROTECT AGAINST VOLTAGE RETURNS AS INDICATED IN TABLE 2.6 AND THE FOLLOWING TABLE:

If necessary a system against voltage return needs to be created in the UPS distribution panel as shown in diagram 2.6b

A**:** general mains circuit breaker / switch
C: automatic switch or at least a fuse for the mains
B: automatic switch or at least a fuse for the reserve network
K3: protection contactor against return voltage
K1-K2: additional relays on the change-over contact coil supply

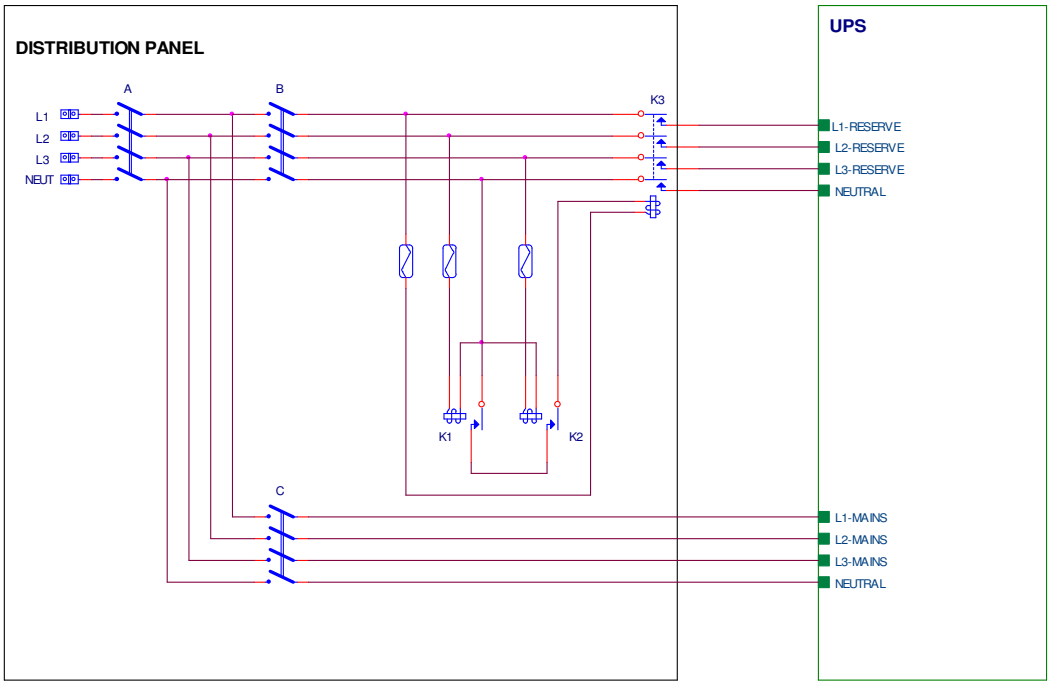


Diagram 2.6b

WARNING!!

BEFORE CONNECTING THE UPS MAKE SURE THE LINES THAT CONNECT THE UPS MAINS AND RESERVE INPUTS TO THE DISTRIBUTION PANEL ARE OPEN AND DISCONNECTED MAKE SURE THAT THE BATTERY PANEL SWITCH IS OPEN. PUT WARNING SIGNS ON THE DISTRIBUTION PANEL AND BATTERY PANEL TO PREVENT ACCIDENTAL ACTIONS.

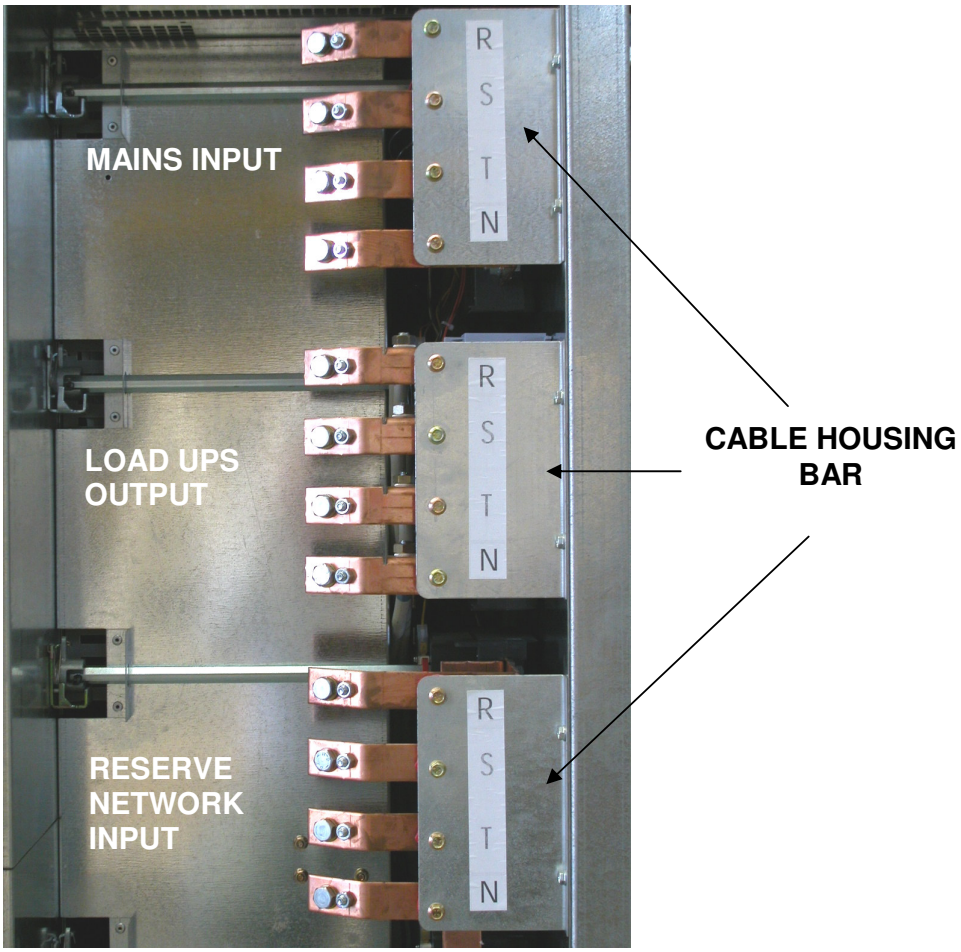


Figure 2.6: Detail of open UPS panel to show cable entrance

Before connecting the UPS it is necessary to:

- make sure that the mains voltage and frequency match those indicated on the adhesive plate located on the inside of the right door of the UPS (input voltage, operating frequency, etc.);
- make sure that the earthing of the system fully complies with the requirements of IEC standards or local laws.

Then install four pole magnetothermal switches (see Fig.2.6b) upstream and downstream from the UPS with the following specifications:

- capacity equal or greater than what is indicated on the label inside the right door (KVA);

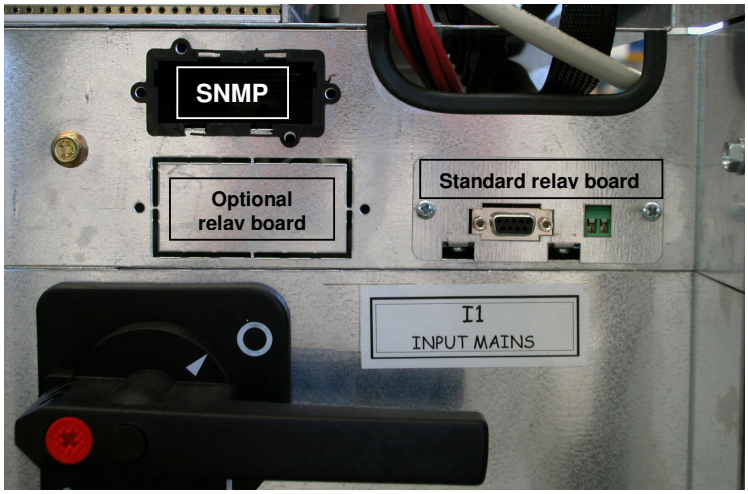
- specifications in compliance with IEC standards or local laws for **Curve C**" magnetothermals.

- The connections needs to be made using flexible cables with a cross-section (minimum) as indicated in the following table:

P (KVA)	Ø A.C. (mm^2)	I A.C. (A)	Ø D.C. (mm^2)	I D.C. (A)
160 (KVA)	95	242	2x50	350
200 (KVA)	2x50	302	2x70	438
250 (KVA)	2x70	378	2x95	547
300 (KVA)	2x95	454	2x120	600

2.7 UPS AUXILIARY CONNECTIONS

The communication boards are housed above the UPS disconnection parts. The standard equipment is composed of a remote communication board (CS0098) and set-up for the SNMP board.
It is possible to install another optional remote communication board (CS0098) in addition to the standard one upon request (for. 2.7a).
Access for the connections to these devices is located on the rear part of the UPS (fig.2.7b)



2.7.1 Remote communication board

Remote communication board is used to allow connection between the UPS and external device.
The board has a series of voltage free contacts terminals (M1) which can be connected to a dedicated synoptic panel (chap. 2.7.2), acoustic or visual warning device or remote signalling systems.
One or more remote EPO buttons (chap. 2.7.4) can be connected via the other two contacts (CN1). Lastly, it's possible to connect the system to a PC via a DB9 connector (CN3) and use the specific software (chap. 2.7.3)

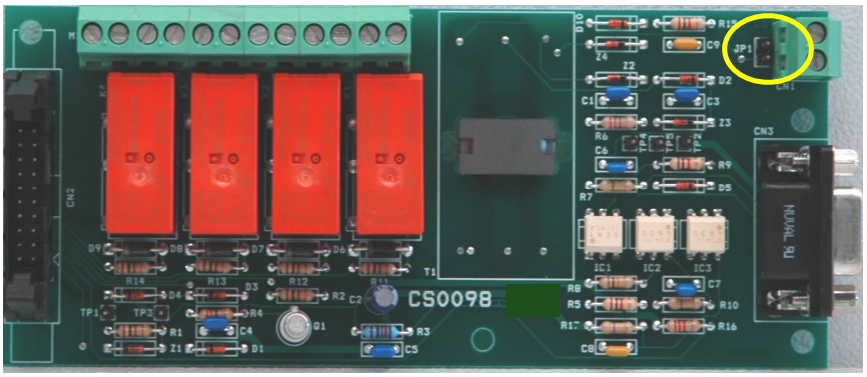


Fig. 2.7.1a

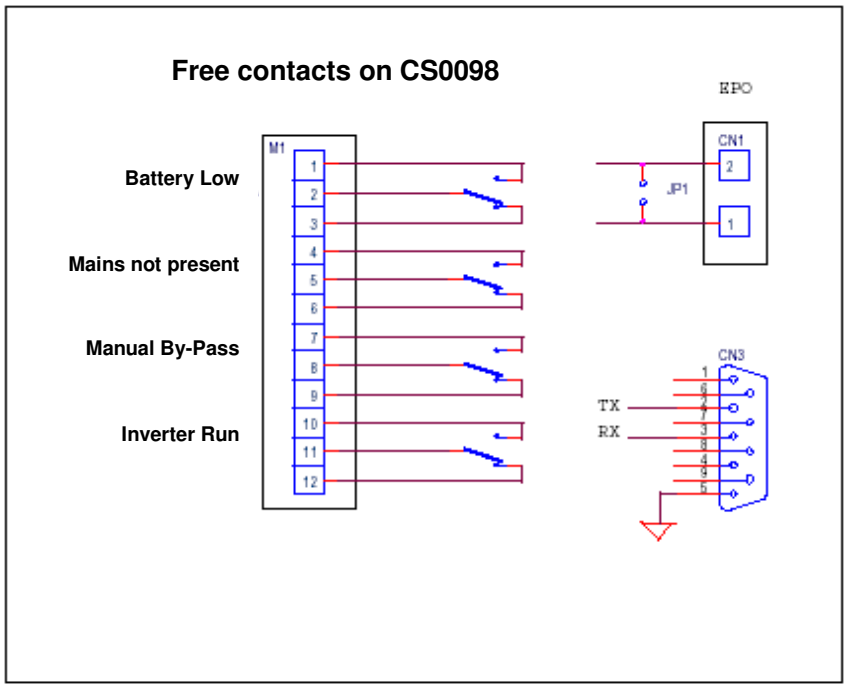


Fig. 2.7.1b

2.7.2 Synoptic panel

This is connected to the UPS via the terminal board M1 located on the remote communication board (CS0098)(connection diagram fig. 2.7.2a). This device is used for remote monitoring of the main UPS blocks, the status of the main blocks is represented through LEDs, and there is also an acoustic alarm, which can be shut off with key 5.

LED description

1)Green ON UPS LED
If on the UPS is operating correctly
If off it indicates that one or more inverter section alarms are present (acoustic alarm enabled)

2)Yellow ON BATTERY LED
If on the UPS is operating by battery
(acoustic alarm enabled)

3) Red LOW BATTERY LED
If on it indicated imminent end of battery discharge
(acoustic alarm enabled)

4) Yellow ON BYPASS LED
If on it indicates load supplied from reserve
(acoustic alarm enabled)

5) ALARM SILENCE key
Used to shut off the acoustic alarm

6) Green LED
If on it indicates correct power supply to synoptic panel

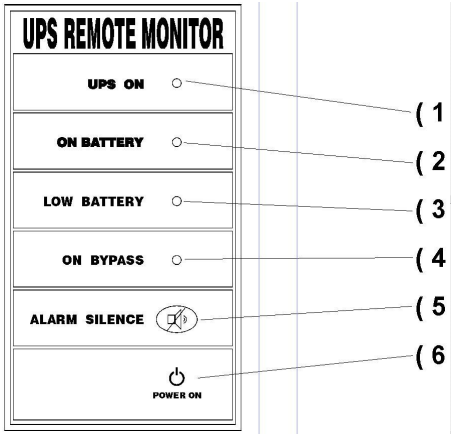
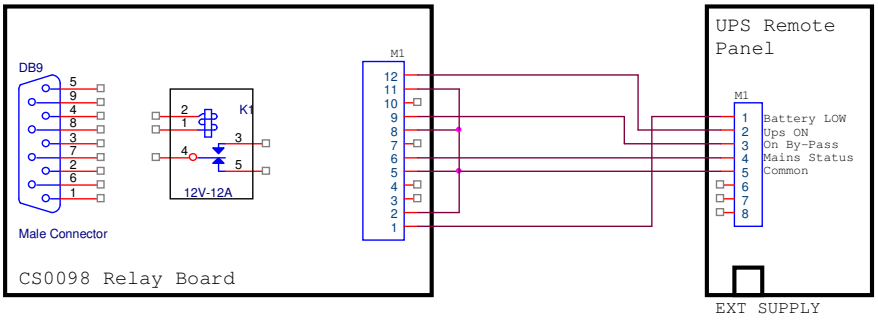


Fig. 2.7.2b




```
CS0098          UPS
Relay           REMOTE
Board           PANEL

   1 ──────────── 1
  12 ──────────── 2
   9 ──────────── 3
   6 ──────────── 4
2-5-8-11 ──────── 5

NOTE:
ON CS0098 COMMON TAGBLOCKS (2-5-8-11)
MUST BE CONNECTED TOGETHER
```

Fig. 2.7.2a

2.7.3 Ups Management Software

This software is used to monitor the conditions of the UPS via a PC connected to the system by the supplied cable.
For more information on the installation and use of the software see the manual that came with it.

2.7.4 Remote EPO Button

Particular attention must be paid to the external connection of buttons or actuators for the EPO function (emergency stop). This connection is composed of a series or normally-closed switches which open the series if commanded, generating the stop of the UPS with the consequent and irreversible interruption of voltage to the load. The series of external EPO buttons must be connected to the CN1 terminal board of the relay board CS0098 (Fig.2.7.4). If there are no external EPO contacts to the **system jumper JP1 must be enabled. (circle in fig.2.7.1a)**
The default configuration (without the ext. E.P.O connected) has the connector CN1 shortened with a wire connection, it must be removed (as well as the jumper JP1), when one or more E.P.O. ext. will be connected to the board as described above.

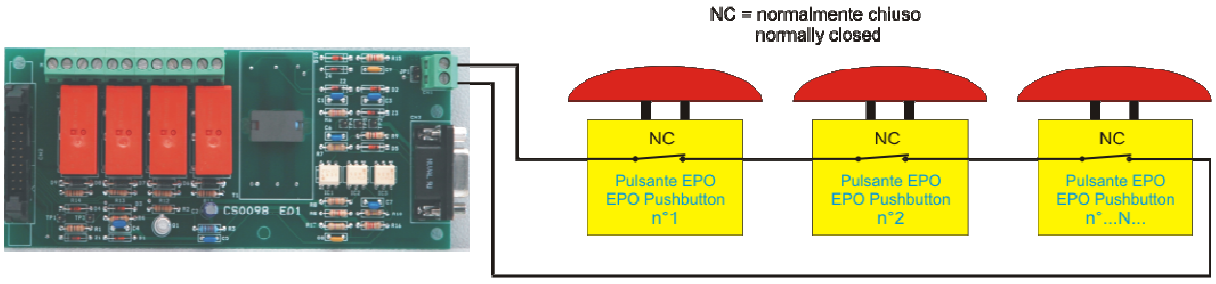


Fig. 2.7.4

2.8 EARTHING

The earth input cable must be connected to the earth connector of the UPS and ***must be always the first cable to be connected.*** It is advisable to insert an appropriate antioxidant between the earth bar and lug to keep the correct contact over time.

All of the cabinets and accessories must be earthed in accordance with local regulations.

WARNING !!

INADEQUATE EARTHING MAY CAUSE A RISK OF ELECTRIC SHOCKS TO PERSONNEL OR FIRE.

3 CONTROL PANEL

3.1 INTRODUCTION

The control panel is located on the front part of the UPS, it is used to easily check the general status of the UPS, batteries and related alarms.
The control panel is composed of an LCD display which indicates the operating status, measurements and alarms of the UPS and an EPO button located at the lower right of the panel.
The display panel shows text messages and operating parameters on an LCD screen with 4 lines and 20 characters per line.
The screens are organised in 7 multi-level menus, which can be selected using the membrane buttons under the LCD display.

Figure 3-1a

Two LEDs are present on the left side of the display, a green one called “NORMAL” and a red one called “ALARM”.
The actions of the LEDs are summarised in table 3.1a.

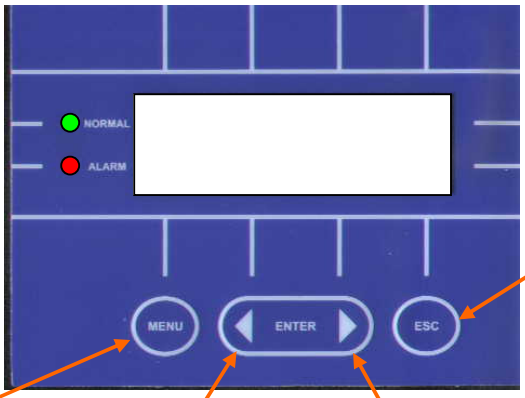
STATUS	UPS OK	Alarm present	Alarm stopped
GREEN LED	on	off	on
RED LED	off	on	flashing

Tabella 3.1a

In the event of parallel systems during normal operation the green LED will flash on the master UPS to identify it.

LCD control panel

Figure 3-1b Composition of LCD panel



ESC PUSHBUTTON
Shut off the buzzer

MENU'PUSHBUTTON
To return to the previous level menu

BACK PUSHBUTTON **NEXT PUSHBUTTON**
It is possibile to scroll between the 7 mains menu or submenu. By pressing it at the same time you select ENTER

During normal operation of the UPS the control panel uses a series of messages to display the operating status of the single component blocks of the system, thus the operator is informed in real time (buzzer) of any faults presented by the system. Table 3-1b summarises the list of available menus in order.

MENU	N°	NOTES
Status or alarm display	1	If keys are not used on another menu after 3 minutes, it returns always open
Measurement display	2	Used to display the values of all the measurements
UPS controls	3	Inverter on / off, static switch, batt. test
Guided procedures	4	Displayed when the system is turned on
Panel configuration	5	Setting for date / time / batt. test / language
Event log display	6	Displays the log of events and related alarms
Service	7	Reserved for technical assistance service

Table 3-1b

It is possible to scroll between the 7 menus listed in table 3-1b using the *NEXT(>)* or *BACK(<)* keys.
By pressing the *NEXT(>)* and *BACK(<)* keys at the same time you select *ENTER (< >)* and by confirming the selection go to the next level..
To return to the previous level press the *MENU* key
Each alarm indication on the display is followed by a buzzer which can be shut off by pressing *ESC* (see figure 3-1b)

When the UPS is turned on the display is automatically positioned in menu no. 4 "**GUIDED PROCEDURES**" which proposes turning on the system.
At this point the operator can decide whether to follow the proposed procedure by following the instructions shown on the display until the system is completely activated or perform operations different than turning on the system via the MENU key.

If the operator does not perform any action, the "STATUS AND ALARM DISPLAY 1" menu is automatically displayed after 3 minutes.

3.2 MENU 1: STATUS OR ALARM DISPLAY

This menu is characterised by the first line of the message which can be UPS OPERATING (if the UPS is operating normally) or UPS ALARM (if the UPS has an alarm condition). The meanings of the displayed messages are given below:

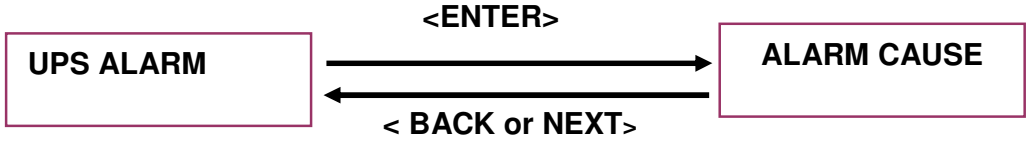
UPS IN NORMAL OPERATING CONDITIONS

MESSAGE	MEANING
MAINS SUITABLE / NOT SUITABLE	The input mains line is on and the voltage is / is not in the specified range
RESERVE SUITABLE / NOT SUITABLE	The input by-pass supply line is on and the voltage is / is not in the specified tolerance
BATTERY VOLTAGE SUITABLE	The battery voltage is within the specified limits
INVERTER ON	The inverter is on and operating normally
INVERTER – RESERVE SYNCHRONISED / NOT SYNCHRONISED	Indicates the normal synchronisation status between the inverter and by-pass line
LOAD ON INVERTER	The load is supplied by the inverter
LOAD ON RESERVE	The load is supplied by the by-pass line. This may be a temporary condition which lasts 20 seconds when there is a short overload
MASTER UPS	Controls the UPS in parallel
SLAVE UPS	Controlled by another UPS in parallel

Table 3-

3.2.1 UPS in fault conditions

If the UPS has a fault, the status screen will be replaced with the alarm one.
A message will appear on the type of fault that occurred. A buzzer will be activated that can be shut off by pressing the *ESC* key. By *ENTER (< >)* a list of indications will be displayed to guide the operator to understand the meaning of the alarm. The *<BACK or NEXT>* keys can be used to scroll between the various indications. When the alarm condition is removed, the LCD returns to the default screen



The possible alarms and associated help messages are listed below.

ALARM MESSAGE	MEANING
INVERTER OFF	The load is no longer supplied by the inverter and thus subject to any mains failures
INVERTER OVERLOAD	The inverter is off due to an overload and the uses are supplied by the reserve network
STATIC SWITCH BLOCKED	After 3 unsuccessful automatic switching attempts from the reserve to inverter, the UPS blocks the static switch on the reserve network
BATTERY FAULT BATTERY TEST FAILED	Displayed whenever the periodic test on the battery fails for any reason
BATTERY PREALARM	At a battery voltage of around 440V the UPS warns the user of a low battery value At 400V discharging ends and the UPS goes off
STATIC SWITCH FAULT	One or more output phases missing
MANUAL BY-PASS ENABLED	Displayed when the manual BY-PASS circuit breaker is closed
MAINS NOT SUITABLE	The mains is not suitable for the UPS specifications, it may be higher or lower than the tolerances allowed by the system, or simply not present
RESERVE NOT SUITABLE	The reserve is not suitable for the UPS specifications, it may be higher or lower than the tolerances allowed by the system, not present or with incorrect cyclic direction
EMERGENCY STOP	Displayed whenever the E.P.O. button is pressed, for whatever reason
BATTERY CHARGER FAULT	Displayed for a fault in the battery charger or if it is not connected
NO PARALLEL DATA EXCHANGE	This alarm occurs when there is not data exchange between various UPS in parallel, for whatever reason It may be due to a missing or incorrect connection of one or more parallel fibres

3.3 MENU' 2: MEASUREMENT DISPLAY

To access this screen press *ENTER* on ***2.Measurement Display*** on the main menu
The operator can now check the value of the following electrical measurements by scrolling with the arrows < or >:

V in phase - neutral = reserve network Y-voltage
V in phase/phase = reserve network voltage between lines
Input current = UPS input three phase currents

V out phase/neutral = UPS output Y-voltage
Output current = output current at load
Battery V,I = battery voltage and current
KVA,KW power distributed = power distributed by UPS
Power factor = power factor distributed by UPS
Frequency = UPS output frequency

If no operation is performed, the "STATUS AND ALARM DISPLAY 1" menu is displayed after 3 minutes.

3.4 MENU' 3: UPS CONTROLS

From this menu it is possible to give operating control to the UPS.

MESSAGE	MEANING
3.1 INVERTER ON 3.2 INVERTER OFF	With this message by pressing ENTER the use can turn the inverter permanently on or off It is necessary to turn the inverter on when starting and after a stop for a permanent overload.
3.3 SWITCH LOAD TO INVERTER	With this message by pressing ENTER the load is moved from the reserve line to the inverter.
3.4 SWITCH LOAD TO RESERVE	With this message by pressing ENTER the load is moved from the inverter to the reserve line.
3.5 RUN BATTERY TEST	With this message by pressing ENTER an automatic test will be started instantaneously on the battery, which lasts for around 30 seconds.

If no operation is performed, the "STATUS AND ALARM DISPLAY 1" menu is displayed after 3 minutes.

3.5 MENU' 4: GUIDED PROCEDURES

MESSAGE	MEANING
4.1 UPS START-UP	Guides the operator for starting the machine step by step
4.2 SHUTDOWN	Guides the operator for shutting down the machine step by step
4.3 MANUAL BYPASS ACTIVATION	Guides the operator for shutting down the UPS maintaining power to the uses from the reserve network via manual bypass
4.4 MANUAL BYPASS DEACTIVATION	Guides the operator for reactivating the UPS maintaining power to the uses starting from manual bypass

If no operation is performed, the "STATUS AND ALARM DISPLAY 1" menu is displayed after 3 minutes.

3.6 MENU 5: PANEL CONFIGURATION

MESSAGE	MEANING
5.1 DATE SETTING	Used to set the current date, using the arrows to increase / decrease the numbers
5.2 TIME SETTING	Used to set the current time, using the arrows to increase / decrease the numbers
5.3 BATTERY TEST SETTING	Used to set the periodic battery test, selecting the day of the week, the number of weeks between one test and the next and the time of day to start the test
5.4 LANGUAGE SETTING	Used to select the display language between Italian, Spanish, English, French or German

If no operation is performed, the "STATUS AND ALARM DISPLAY 1" menu is displayed after 3 minutes.

3.7 MENU 6: EVENT LOG DISPLAY

In this menu the user can scroll through the last 1024 events / alarms in chronological order.
The event log display can be opened by selecting ***6. EVENT LOG*** in the main menu and then *DISPLAY LOG*. The screen will show the date and time of the last event that occurred.
It is possible to scroll the list using the buttons *<BACK or NEXT>*
In all positions on the event list, by pressing *MENU* the display returns to the *MAIN MENU*.
To delete all the events select DELETE EVENTS from the submenu and then press <ENTER>.

If no operation is performed, the "STATUS AND ALARM DISPLAY 1" menu is displayed after 3 minutes.

3.8 MENU 7: SERVICE

The control board can be connected to a laptop via optical fibres, in order for servicing personnel to perform troubleshooting or change the calibrations of the UPS.
To perform this procedure or check the signalling program software revision, you need to enter the menu *7. SERVICE PROCEDURES*, however this menu is protected by password and cannot be accessed by unauthorised personnel.

If no operation is performed, the "STATUS AND ALARM DISPLAY 1" menu is displayed after 3 minutes.

4 INSTRUCTIONS FOR USING THE UPS

4.1 INTRODUCTION

This chapter describes the control parts of the UPS which can be used by the operator to correctly use the system.
The UPS may be in one of the following operating conditions:

- **Normal** operation - The load is supplied by the UPS.
  The UPS is in normal operation and uses mains supply to supply energy to the uses and charge the batteries.
  This mode guarantees complete uninterrupted power to the uses.
  Operation with internal automatic by-pass – The load is supplied by the mains
  In the event of an inverter fault and/or overload, the power to the uses is guaranteed by the reserve network.
  This mode does not guarantee complete uninterrupted power to the uses.
- **Operation with maintenance manual by-pass enabled** – The UPS is disabled.
  The load is connected directly to the mains through the maintenance or emergency manual by-pass line.
  This mode does not guarantee complete uninterrupted power to the uses.
- **Battery operation** - The load is supplied by the UPS.
  The UPS is in normal operation and uses battery supply to supply energy to the uses because the mains is not present.
  This mode guarantees complete uninterrupted power to the uses.

4.2 POWER SWITCHES

The UPS control parts are located behind the right front door and are installed vertically in the order described below (see fig. 4.3):

MAINS INPUT SWITCH (I1): connects the UPS to the mains input supply.
USES OUTPUT SWITCH (I4): connects the UPS to the uses
RESERVE INPUT SWITCH (I2): connects the UPS to the reserve network supply.
MANUAL BY-PASS SWITCH (I3): used to disable the UPS keeping the uses supplied by the mains
It is protected by a mechanical lock to prevent accidental operations.

All of the UPS circuit breakers have been described with the exception of the battery circuit breaker, ***which is located on the battery panel, or at least outside the UPS cabinet***

To completely isolate the machine from hazardous voltages it is necessary to also open the battery switch, not present on the UPS.
Also remember that the presence of potentially loaded capacitors inside the converter means you must wait for at least 10 minutes before accessing the internal parts of the machine.

WARNING !!

A HORIZONTAL LEVER IS THE SAME AS AN OPEN SWITCH, A VERTICAL LEVER (TURNED CLOCKWISE) IS THE SAME AS A CLOSED SWITCH

In fig. 4.3 all the switches are shown in the OFF position:

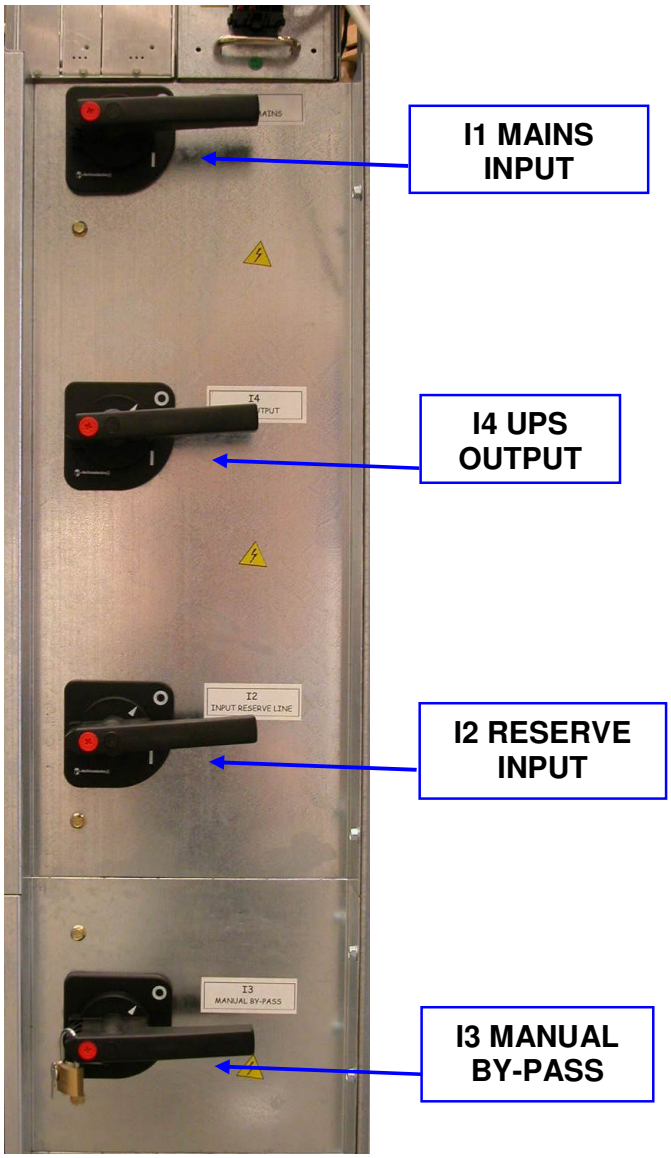


Fig. 4.3

WARNING

All of the operations described in the following paragraphs must be performed by authorised electricians or trained personnel.

4.3 GUIDED PROCEDURES

Using the selection in this menu it is possible to perform the following operations:

- *Turn on UPS;*
- *Turn off UPS;*
- *Enable manual by-pass*
- *Return from manual By-Pass to normal UPS operation.*

Based on the selection made, the LCD will display all the operations that need to be performed by the operator to correctly activate the selected option.
The operator will be guided by a series of messages indicating the actions to perform on the circuit breakers on the machine and the controls to make through the display.
At the end of each one, if everything has been performed correctly, a confirm correct performance message will appear.

It is possible to perform the operations listed above without using the guided procedures, in this case exit from the menu "**4. GUIDED PROCEDURES**" and follow the instructions listed in the paragraphs below.

4.4 INSTRUCTIONS FOR TURNING ON THE UPS

This procedure is used to bring the UPS to normal operating conditions started from a completely unpowered system.
Before starting make sure that the system and all the electrical connections have by checked by authorised personnel and that the external power switches are closed

Make sure the lever of the MANUAL BY-PASS I3 switch is in the OFF position and mechanically locked (safety lock).

MAKE SURE THE PHASE CYCLIC DIRECTION IS CORRECT FOR THE MAINS AND RESERVE NETWORK INPUT

See fig. 4.3 for the switches.

If all of the points above have been checked, you can start the system as follows:

1. Close the RESERVE NETWORK I2 circuit breaker.

The LCD and all the UPS logics will begin operation (to disable the guided procedure proposed by the UPS default menu and access normal operating mode, press the *MENU* key)
If the supply is correct on the reserve line the exchanger fans will go on.

2. Close the UPS OUTPUT I4 switch

The loads connected to the UPS output will be supplied.

3. Close the MAINS INPUT I1 switch

Wait for 10 seconds. A gradual start-up sequence of the main rectifier will be starter, so that preloading of the internal capacity of the machine is carried out without causing mains side overcurrents.
The INVERTER OFF message will appear on the LCD

4. Activate the inverter

Using menu **3. CONTROL MODE** select ***Inverter ON*** and press *ENTER*

5. Check inverter network switching

Wait 30 seconds, after which the static switch will automatically switch the load from reserve line to inverter.
Check the correct operating status, indicated if the green LED is on on the control panel.

6. Battery connection

Close the battery panel switch thus connecting it to the UPS only after checking the correct polarity of the battery connection.

At this point the machine is in normal operating mode, and is able to guarantee uninterrupted power supply to the uses.
It is advisable to simulate a power failure and ending of the failure to check the correct operation of the entire UPS / Battery system.
To perform this operation open and reclose the mains switch upstream from the UPS.

WARNING:

The start sequence described above must always be followed, in particular, remember THE SYSTEM CANNOT BE STARTED FROM THE BATTERY.

4.5 INSTRUCTIONS FOR ENABLING THE MANUAL BY-PASS

If for maintenance purposes or other reasons you want to transfer the power supplies of critical uses directly to the mains, disabling the UPS in order to run tests on it or service it, proceed as follows:

1. Select menu 3. CONTROL MODE

Select the item ***"transfer load to reserve network"*** and press *ENTER*
The uses will now be supplied directly from the reserve network

2. Turn off the inverter

Using menu **3. CONTROL MODE** select ***Inverter OFF*** and press *ENTER*
This turns off the inverter and uninterrupted supply to the uses is no longer guaranteed

3. Close MANUAL BY-PASS I3:

Remove the lock or any other mechanical safety lock from the switch and close it

4. Open the MAINS I1 circuit breaker

5. Open the RESERVE NETWORK I2 circuit breaker

The uses are directly supplied by the mains through the manual By-Pass

6. Open OUTPUT I4 circuit breaker

7. Disconnect the battery

At this point the uses are directly supplied by the reserve network and the UPS does not have any hazardous voltage inside it <u>with the exception of the compartment where the input / output cables are housed, which is closed by a panel and the inverter DC and AC capacitors for a few minutes</u> , however, to access then a metallic panel covering needs to be removed.

4.6 INSTRUCTIONS FOR RETURNING FROM MANUAL BY-PASS TO NORMAL OPERATION

To return to normal operating conditions starting from the load on manual bypass, proceed as follows:

1. Close the RESERVE INPUT L2 circuit breaker.

At this point, if the supply on the reserve network is present and suitable the LCD display goes on and all of the machine control start operation.
The display automatically goes on the in **GUIDED PROCEDURES** mode, press the *MENU* key to exit.

2. Close OUTPUT L4 circuit breaker

3. Open MANUAL BY-PASS L3 circuit breaker

At this point the uses will be supplied by the reserve network
Put the mechanical lock back on the manual by-pass circuit breaker l3

4. Close the MAINS INPUT L1 switch

Wait for 10 seconds. A gradual start-up sequence of the main rectifier will be starter, so that preloading of the internal capacity of the machine is carried out without causing mains side overcurrents.
The *INVERTER OFF* message will appear on the LCD

5. Start the inverter

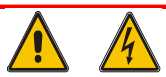
Using menu **3. CONTROL MODE** select **Inverter ON** and press ENTER

6. Check inverter network switching

Wait 30 seconds, after which the static switch will automatically switch the load from reserve line to inverter.
Check the correct operating status, indicated if the green LED is on on the control panel.

7. Battery connection

Close the battery panel switch thus connecting it to the UPS only after checking the correct polarity of the battery connection.



WARNING !

The battery and its circuit breaker MUST always be connected to the UPS only at the end of the start-up procedure, otherwise the system may not work

4.7 INSTRUCTIONS FOR COMPLETELY SHUTTING OFF THE UPS

If for maintenance or other reasons you want to completely shut off the system and leave the uses unpowered, proceed as follows:

1. Select menu 3. CONTROL MODE

Select the item ***"transfer load to reserve network"*** and press *ENTER*
The uses will now be supplied directly from the reserve network

2. Turn off the inverter

Using menu **3. CONTROL MODE** select **Inverter OFF** and press *ENTER*
This turns off the inverter and uninterrupted supply to the uses is no longer guaranteed

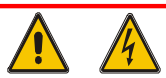
3. Open LOAD 14 circuit breaker

Power supply to the uses will no longer be supplied

4. Open the RESERVE INPUT 12 circuit breaker.

5. Open the MAINS 11 circuit breaker.

6. Disconnect the Battery



At this point the UPS does not have any hazardous voltage inside it with the exception of the compartment where the input / output cables are housed, which is closed by a panel and the inverter DC and AC capacitors for a few minutes, however, to access then a metallic panel covering needs to be removed.

4.8 E.P.O. (EMERGENCY POWER OFF) EMERGENCY STOP

The purpose of the emergency stop is to completely shut off the UPS if necessary with the consequent and immediate opening of the static switch on the mains and inverter sides. This removes the power supply and uninterrupted power supply to the uses.
Obviously, hazardous voltages remain inside the UPS panel.

4.9 INSTRUCTIONS FOR TURNING ON THE UPS IN POWER SAVE MODE

This procedure must be followed to start the UPS beginning from a completely unpowered system.
Before starting make sure that the system and all the electrical connections have been checked by authorised personnel and that the external power switches are thus closed

Make sure the lever of the MANUAL BY-PASS I3 switch is in the OFF position and mechanically locked (safety lock).

MAKE SURE THE PHASE CYCLIC DIRECTION IS CORRECT FOR THE MAINS AND RESERVE NETWORK INPUT

See fig. 4.3 for the switches.

If all of the points above have been checked, you can start the system as follows:

1. Close the RESERVE NETWORK I2 circuit breaker.

The LCD and all the UPS logics will begin operation (to disable the guided procedure proposed by the UPS default menu and access normal operating mode, press the MENU key)
If the supply is correct on the reserve line the exchanger fans will go on.

2. Close the UPS OUTPUT I4 switch

The loads connected to the UPS output will be supplied.

3. Close the MAINS INPUT I1 switch

Wait for 10 seconds. A gradual start-up sequence of the main rectifier will be starter, so that preloading of the internal capacity of the machine is carried out without causing mains side overcurrents.
The INVERTER OFF message will appear on the LCD

3. Activate the inverter

Using menu 3**. CONTROL MODE** select ***Inverter ON*** and press ENTER
Check the correct operating status, indicated if the green LED is on on the control panel

4. Battery connection

Close the battery panel switch thus connecting it to the UPS only after checking the correct polarity of the battery connection.

At this point the machine is in normal operating mode, and is able to guarantee uninterrupted power supply to the uses.
It is advisable to simulate a power failure and ending of the failure to check the correct operation of the entire UPS / Battery system.

To perform this operation open and reclose the mains switch upstream from the UPS.

The start sequence described above must always be followed, in particular, remember THE SYSTEM CANNOT BE STARTED FROM THE BATTERY.

4.10 INSTRUCTIONS FOR ENABLING THE MANUAL BY-PASS IN POWER SAVE MODE

If for maintenance purposes or other reasons you want to transfer the power supplies of critical uses directly to the mains, disabling the UPS in order to run tests on it or service it, proceed as follows:

1. Turn off the inverter

Using menu 3**. CONTROL MODE** select ***Inverter OFF*** and press ENTER
This turns off the inverter and uninterrupted supply to the uses is no longer guaranteed

2. Close MANUAL BY-PASS I3:

Remove the lock or any other mechanical safety lock from the switch and close it

3. Open the MAINS I1 circuit breaker

4. Open the RESERVE NETWORK I2 circuit breaker

The uses are directly supplied by the mains through the manual By-Pass

5. Open OUTPUT I4 circuit breaker

6. Disconnect the battery

At this point the uses are directly supplied by the reserve network and the UPS does not have any hazardous voltage inside it with the exception of the compartment where the input / output cables are housed, which is closed by a panel and the inverter DC and AC capacitors for a few minutes , however, to access then a metallic panel covering needs to be removed.

4.11 INSTRUCTIONS FOR RETURNING FROM MANUAL BY-PASS TO NORMAL OPERATION IN POWER SAVE MODE

To return to normal operating conditions starting from the load on manual bypass, proceed as follows:

1. Close the RESERVE INPUT I2 circuit breaker.

At this point, if the supply on the reserve network is present and suitable the LCD display goes on and all of the machine control start operation.
The display automatically goes on the in GUIDED PROCEDURES mode, press the *MENU* key to exit.

2. Close OUTPUT I4 circuit breaker

3. Open MANUAL BY-PASS I3 circuit breaker

At this point the uses will be supplied by the reserve network
Put the mechanical lock back on the manual by-pass circuit breaker I3

4. Close the MAINS INPUT I1 switch

Wait for 10 seconds. A gradual start-up sequence of the main rectifier will be starter, so that preloading of the internal capacity of the machine is carried out without causing mains side overcurrents.
The *INVERTER OFF* message will appear on the LCD

5. Start the inverter

Using menu 3. CONTROL MODE select *Inverter ON* and press *ENTER*
Check the correct operating status, indicated if the green LED is on on the control panel

6. Battery connection

Close the battery panel switch thus connecting it to the UPS only after checking the correct polarity of the battery connection

WARNING !

The battery and its circuit breaker MUST always be connected to the UPS only at the end of the start-up procedure, otherwise the system may not work

4.12 INSTRUCTIONS FOR COMPLETELY SHUTTING OFF THE UPS IN POWER SAVE MODE

If for maintenance or other reasons you want to completely shut off the system and leave the uses unpowered, proceed as follows:

1. Turn off the inverter

Using menu 3. **CONTROL MODE** select ***Inverter OFF*** and press ENTER
This turns off the inverter and uninterrupted supply to the uses is no longer guaranteed

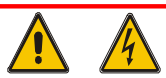
2. Open LOAD 14 circuit breaker

Power supply to the uses will no longer be supplied

3. Open the RESERVE INPUT 12 circuit breaker.

4. Open the MAINS 11 circuit breaker.

5. Disconnect the Battery



At this point the UPS does not have any hazardous voltage inside it with the exception of the compartment where the input / output cables are housed, which is closed by a panel and the inverter DC and AC capacitors for a few minutes, however, to access then a metallic panel covering needs to be removed.

4.13 MANAGING THE UPS BATTERY

In addition to the battery voltage and current measurements, displayed in menu **2** ***"MEASUREMENT DISPLAY"***, it is also possible to test the battery efficiency without risks a power interruption to the uses, even if the battery is not efficient.
The test uses the jumper run by mains input to lower the voltage to the converter to the until the starting battery discharge threshold; if the latter is efficient, at 2V/el it starts to distribute current, if not a "***BATTERY TEST FAILED***" alarm is displayed.
In this situation called the technical assistance centre.

4.14 BATTERY TEST PROGRAMMING

The battery test can be starter at any time by the operator by selecting the menu ***"3. CONTROL MODE"*** and pressing *ENTER* on ***"BATTERY TEST".***
The test lasts around 30 seconds.
It is possible to programme a periodic battery test by following the instructions below:
1. Select the **"PANEL CONFIGURATIONS"** menu pressing *ENTER*
2. Select the **"BATTERY TEST SETTING"** by pressing *ENTER*.
Using the arrows and *ENTER* you select, starting from the left, the day of the week for performing the test, the number of weeks between one test and the next (from 1 to 99 – N.B. week 0 corresponds to an unperformed automatic test) and the time of day for running the test.

5 UPS IN PARALLEL

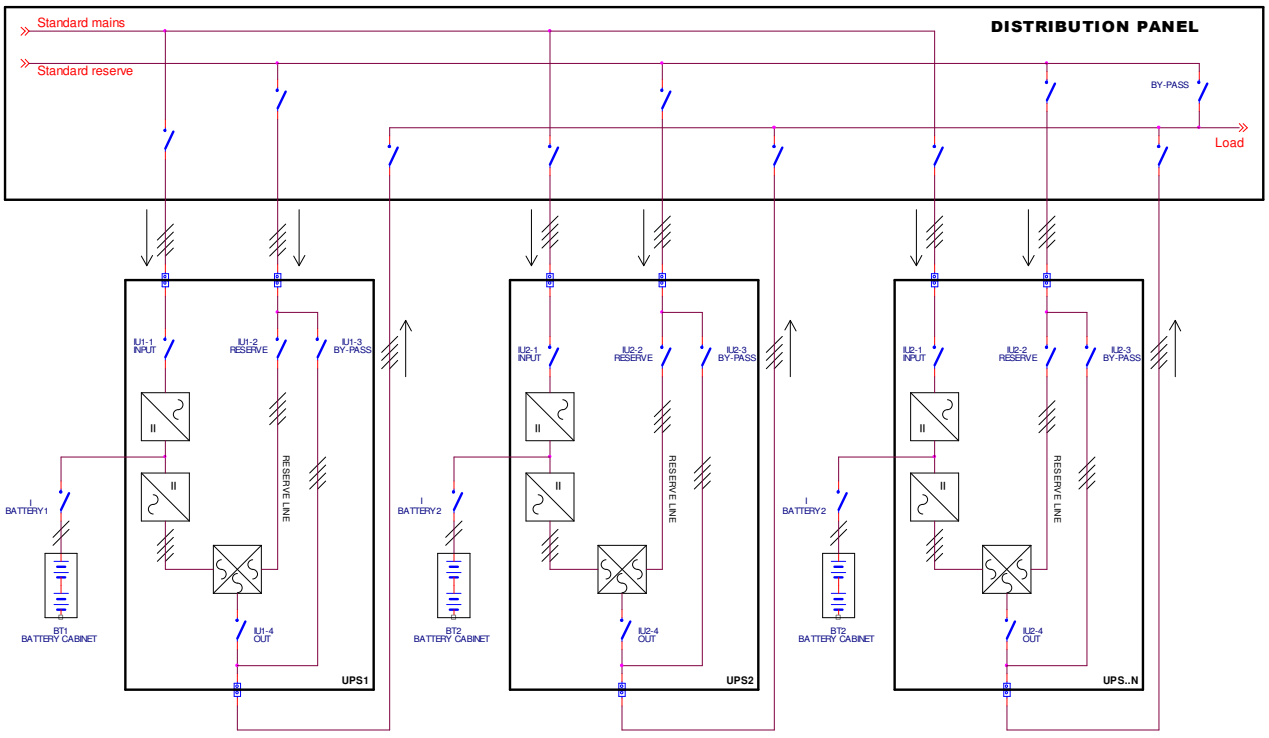
5.1 SYSTEM SET-UP

The installation of various UPS in parallel requires creating one or more panels of the single UPS.
The type of panel created guarantees different levels of operation based on the complexity of the adopted solution.
The typical, normally suggested solution is described below, which guarantee complete operation of the system. (fig.5.1)

Disconnections are included on all the power lines of the single groups, disconnection of the their return line and protection of the batteries.
Moreover, it is advisable to set-up a general by-pass for the system, for this purpose implementation of a functional interlocking device is recommended.
This interlocking device is necessary to prevent damage to the system

The indicated solution permits all the testing operations in the installation and maintenance phases of the single groups.

The general manual by-pass can be used to isolate the entire system without load supply interruptions.



The complexity of the system requires opportune monitoring of the status of each UPS by remote or SNMP see chap. 1.2.4 page 7

For additional information on in parallel machine, see the attached technical report DT0367. (only for in parallel systems)

6 MACHINE FAULTS

6.1 GENERAL ALARMS

In the event of a fault on the UPS, the default screen will be replaces by an alarm which will show one of the messages described in the table:

ALARM MESSAGE	CAUSE	ACTION
INVERTER OFF	Initial start-up Permanent overload	Start the inverter Check the output
INVERTER OVERLOAD	Continuous overload on UPS output	Check the output load and restart the inverter Check the output short circuit
STATIC SWITCH BLOCKED	High transient loads on UPS output 3 failed switching attempts on inverter	Check the output load and restart the inverter
BATTERY FAULT BATTERY TEST FAILED	Battery test not OK	Check the battery Check the battery fuses
BATTERY PREALARM	Battery almost discharged, the inverter is about to go off	Shut down the connected loads which are not vital
STATIC SWITCH FAULT	One or more output phases missing	Check SCR of the by-pass Check external connections of the by-pass
MANUAL BY-PASS ENABLED	UPS in maintenance	
MAINS NOT SUITABLE	The switch is open. No mains input	Check the mains line voltage and the switch positions
RESERVE NOT SUITABLE	The rotation of the input phase is not correct. No input voltage	Check the voltage of the by-pass line Check the network cyclic direction
EMERGENCY STOP	The EPO control has been activated	Restart the UPS Completely close the switches and battery fuses, wait until the LCD is completely off and then restart the UPS
BATTERY CHARGER FAULT	The B.C. is not correctly connected or is broken	Call technical assistance
NO PARALLEL DATA EXCHANGE	The machine is disabled due to no communication	Call technical assistance

When a UPS has faults which cannot be resolved, and is thus not able to guarantee uninterrupted power to the load, it is a good idea to use the EMERGENCY BYPASS and leave the machine isolated and off. Then call the technical assistance.

In the event of machines in parallel, the faulty UPS, already disabled from the parallel, should be isolated by opening the UPS OUTPUT switch, and then shutting off the machine.
Then call the technical assistance.

In the event of alarms related to temperature, check immediately that there are no leaks of liquid in the cooling circuit (liquid level alarm on the display). If there is a leak, the machine needs to be shut off and isolated, possibly using the emergency bypass procedure.
Then call the technical assistance.

6.2 FIRE

In the extremely remote case of a fire, remember to ***only use CO2 or powder extinguishers***. Always activate the emergency BYPASS and completely shut off the machine, ***disconnecting the battery panel as well.***
For machines in parallel, immediately isolate the machine opening the UPS OUTPUT switch and then opening all the other switches, ***including the battery panel switch.***

6.3 FAULTS RELATED TO THE NATURE OF THE LOAD

Faults are often attributed to the UPS which in reality are normal or abnormal reactions to the load or the installation environment.
The most common situations are described below:

- The UPS is left with load supplied by the reserve network even of the inverter section is operating correctly: this may depend on excessive absorbed peak current, it causes an elevated tension current, which if repetitive, leads to switching of the load on the reserve network.
  The system, after three failed attempts to switch to return on the inverter, blocks the static switch on the reserve line to protect the inverter, therefore it is necessary to study the load current and eliminate the causes of the overcurrents.
  The repetitive peak current should not exceed 2.5 times the effective value.

- The accuracy of the UPS output voltage is not optimal: this may depend on an excessively unbalanced and/or distorting load.

7 SCHEDULED MAINTENANCE

Over the course of its useful life the UPS requires ***scheduled maintenance cycles*** to maintain its operating reliability and efficiency.

Scheduled maintenance must be performed by the company which sells the machine or company specialised and trained on the system by the seller.

7.1 ANNUAL MAINTENANCE (OR SIX MONTHLY IN THE CASE OF HIGHLY CRITICAL MISSION UPS)

Annual maintenance involves the following actions and tests:

- cleaning the machine
- cleaning the control logic and interface boards
- checking the tightening of all nuts and bolts and electrical connections (UPS and battery)
- testing the ventilation efficiency
- cleaning and testing the efficiency of the liquid – air exchanger
- testing the seal of the coolant circuits
- testing the inverter output wave form
- testing output voltage / frequency
- testing synchronisation
- testing signals, alarms and EPO tripping
- display calibration with calibrated instrument
- operating test of manual actuators and automatic devices
- operating test of switching circuits
- power failure test of UPS network, battery efficiency test and test of correct battery charger operation.

7.2 SCHEDULED COMPONENT REPLACEMENT

- Every three years the axial 120x120 mm fans with continual service and centrifugal fans need to be replaced
- The coolant needs to be completely changed every two years
- All the power electrolyte capacitors and circulation pump need to be replaced every four years
- The AC power capacitors need to be replaced every 6 years

N.B.: in terms of battery replacement, this depends on the type used and thus the instructions of the battery manufacturer.